$v_f = v_0 + at$ $x = (1/2)(v_0 + v_f)t$ $x = v_0t + (1/2)at^2$ $v_f^2 = v_0^2 + 2ax$	$\sigma = s/r \quad \omega = v/r \quad \alpha = a_t/r$ $\varpi = \varpi_0 + \alpha t$ $\sigma = (1/2)(\varpi_0 + \varpi)t$ $\sigma = \varpi_0 t + (1/2)\alpha t^2$ $\varpi^2 = \varpi_0^2 + 2\alpha\sigma$
$F=ma$	$\tau = I\alpha$
$p=mv$	$L = I\omega$
$W=F\cos\theta\Delta s$	$W=\tau\sigma$

the force of gravity $F=Gm_1m_2/r^2$ where $G=6.67\times10^{-11}$ N m^2/kg^2
rotational speed = $2\pi r/T$
centripetal acceleration = $v^2/r = \omega^2 r$
circumference = $2\pi r$

$F\Delta t=mv_f - mv_i$ $(1/2)mv_i^2 + mgh_i = (1/2)mv_f^2 + mgh_f$ K.E. = 0.5 mv^2 (no rotation) K.E. = 0.5 mv^2 + 0.5 $I\varpi^2$ (with rotation) $\tau = l F$ $I = mr^2$ angular momentum = $L = I\omega$	PE(spring) = $0.5kx^2$ F(spring) = $-kx$ ρ = mass/V V = Ax (or Ah) $P = F/A$ $A_1v_2 = A_2v_2$ $P_2 = P_1 + \rho g\Delta h$ F_B = weight of displaced fluid Bernoulli: $P_1+0.5\rho v_1^2+\rho gh_1 = P_2+0.5\rho v_2^2+\rho gh_2$

273K = 0°C
atmospheric pressure = 10^5 N / m^2
density lead 11,300 kg / m^3
density water 1,000 kg / m^3; ice 917 kg / m^3
density mercury 13,600 kg / m^3
density pine 550 kg / m^3
density air 1.29 kg / m^3
latent heat of fusion water 3.35×10^5 J / kg
latent heat of vaporization water 22.6×10^5 J / kg
heat capacity water = 4186 J / Kg / °
ice = 2000 J / Kg / ° J / Kg / °
water vapor = 2020
lead = 128 J / kg / °

$Q=mc\Delta T$
$Q=mL_f$ or mL_v

1 mole of ideal gas at 0°C and 1atm pressure
vol=22.4×10^{-3} m^3

constant pressure work = $P\Delta V$
$\Delta U = Q_{in} - W_{out}$
$Q_{Hot} = W + Q_{cold}$ $Q_{cold}/Q_{hot} = T_{cold}/T_{hot}$
$eff=W/Q_{hot} = 1-Q_{cold}/Q_{hot} = 1-T_{cold}/T_{hot}$
<u>ideal gas</u>
$PV = nRT = NkT$
internal energy = $U = 3/2\ NkT = 3/2\ nRT$
Av KE = $1/2\ mv^2 = 3/2\ kT$ (av molec velocity)

k = 1.38×10^{-23} J / K
R = 8.31 J / (mol K)
N = 6.02×10^{23} / mol
Molecular weight
O_2 = 32 g / mole
N_2 = 28
Argon = 40